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ORIGINAL BY REGISTERED MAIL

Montréal, August 10, 2004

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20
SWITZERLAND

Dear Sirs:

RE: International Patent Application
No. PCT/CA2004/000035, filed January 14, 2004
HAY BALE PROCESSOR
Inventor/Applicant: Rousseau, Victor
Our Ref.: 16263-1PCT GH/mb

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AMENDMENT UNDER ARTICLE 19 PCT

This is responsive to the International Search Report and Written Opinion of the International Searching Authority, dated June 16, 2004.

It is respectfully requested that the specification be amended as follows:

IN THE DISCLOSURE

New pages 2, 2A, 7 and 17 are being submitted for replacement of original pages 2, 7 and 17.

IN THE CLAIMS

New claim pages 21 to 27 are being submitted for replacement of original claim pages 21 to 27.

REMARKS

The following amendments have been made to the specification:

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In the disclosure, on page 2, after line 11, a paragraph has been inserted to insert a discussion of document D1, which was considered to be the most pertinent prior art located in the search.

Page 7 was amended at the last line, whereby to cancel reference numeral 38.

Page 17 was amended at line 9, whereby to modify reference to the "door section 117". This has been replaced by the expression --door 170 --.

All of the claims have been amended, whereby to place parenthesis about the reference numerals as appearing therein.

Claim 1 was also amended in a two-part form with its characterizing features.

The dependency of claims 11 and 12 was also altered, whereby to overcome the Examiner's objection to some terminology found therein as not having proper antecedent basis. The previous dependency was an obvious typographical error.

The patentable merits of the present invention over the most pertinent reference cited have been noted by the Examiner, and Applicant is in concurrence therewith.

Respectfully submitted,

ORIGINAL SIGNED PAR

OGILVY RENAULT

Signed by: Guy HOULE

Patent Agent and member of the firm

GH/mb

Encls. - amended specification pages 2, 2A, 7 and 17
- amended claims pages 21 to 27

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storage bins. Known processors also cannot adjust the cut of the fibers within close tolerances whereby to provide an average cut length which is better for admixture with other feed stock material.

Another disadvantage of known hay bale processors is that they are bulky,
5 have hydraulic pumps, need a tractor to operate, are difficult to service, often requiring repair and the knives of the rotor often become gummed and ineffective when cutting hay of the type which has gummy substances.

Another disadvantage of known hay bale processors is that they are dimensioned to accept only certain type and size of bales, i.e. circular or rectangular,
10 and therefore are not versatile whereby to be able to process different size and configuration of bales.

Reference is made to U.S. Patent No. 4,134,554, which discloses a waste paper grinder having an adjustable grid disposed above a fixed rotor in order to regulate the working depth in function of the amount of current demanded by the
15 motor. This type of arrangement has many drawbacks when it comes to hay processing and is quite different from that of the present invention.

SUMMARY OF THE INVENTION

It is a feature of the present invention to provide a hay bale processor which
20 overcomes all of the above disadvantages of the prior art.

Another feature of the present invention is to provide a hay bale processor having a rotor which is supported on a displaceable suspension mechanism whereby the blades are displaced within slot openings of the grill over which is displaced a bale and wherein the blades may be rotated at a substantially constant speed to cut
25 hay from a lower face of the bale.

Another feature of the present invention is to provide a hay bale processor which is provided with a grill having adjustable slot openings whereby to cut the hay into an average fiber cut length as desired by adjusting the size of the slot openings.

Another feature of the present invention is to provide a hay bale processor wherein the rotor is electrically driven by an electric motor which maintains a substantially constant torque on the driveable shaft of the rotor due to the displaceable suspension mechanism of the rotor.

- 5 Another feature of the present invention is to provide a hay bale processor which is easy to service and which can handle bales of various sizes and configuration.

circular rotatable drum 14. A discharge through 18 is secured in a lower portion of the support frame 12 and is provided with a auger screw 19 to discharge cut fibres into a conveying means (not shown) and which can feed the cut fibres into silos or directly into an animal feed mixer or simply to a conveyor to stockpile the cut fibres.

5 As shown in Figure 3, the circular drum is secured to the support frame 11 on a hinge 20 and tilted to an open position, as hereinshown by an actuatable tilting piston 21 having its piston rod end 22 secured at a desired location under the drum bottom wall.

10 As shown in Figure 2, the drum has a bottom wall 23 which is constituted by the top wall 15 hinged on the support frame 11. A rectangular grill opening 24 is disposed in the bottom wall 23 and is offset with respect to the center 25 of the circular bottom wall and extends to one side of the bottom wall and past the center 25 of the drum 14. A grill 26 is disposed in the rectangular grill opening 24 and has a plurality of parallel slot openings 27. The distance between the slot openings 27
15 defines an average fibre cut length therebetween and the openings are adjustable in width, as will be described later.

20 With reference now to Figures 4 to 6 and 9 there will be described the construction and location of the rotor 28. This rotor is held below the grill and its position is illustrated in the cut out portion of the grill in Figure 2. As shown in Figures 4 to 6 the rotor 28 has a driveable shaft 29 to impart axial rotation to the rotor. A plurality of blade support discs 30 are secured in equidistantly spaced relationship by separator discs 31 in a section of the shaft which is disposed under the grill. The discs 30 are provided with blade attachment shoulders 32 with each shoulder having a pair of spaced holes 33 to receive fasteners 34 whereby to secure a
25 cutting blade 35 thereto.

The cutting blades are flat blades of substantially triangular configuration in at least an upper part thereof and are provided with cutting edges 36 on opposed sides leading to an apex 37. The mounting base of the blades are provided with holes to

herein shown the smaller bale 156 is only partly over the grill 26 and therefore there is less resistance on the knives and if the consistency of the hay is very dry and there is very little resistance on the blades they would be fully extended through the slot. However, with large bales 157, if the force on the blades exceeds the set air cylinder
5 pressure, the rotor will descend and maintain a substantially constant rotor speed or cutting blade speed whereby the torque of the motor is maintained substantially constant drawing minimum current.

In order to facilitate maintenance the cylindrical sidewall 16 is provided with a door 170 which is displaceable on a hinge 171 to provide access to
10 the interior of the drum. Two such doors may also be provided in a side by side relationship. Suitable attachment means 172 is provided to reconnect the door section in a closed position.

In order to provide access to the interior, it is necessary to first stop the drum from rotation when in operation. To do so, as shown in Figs. 1B and 1C, there is
15 provided a micro switch 210 secured at a predetermined location on the top wall 15 adjacent the drum side wall 16. A switch activating slide 211 is secured to the drum side wall 16 and rotates therewith. Each time the drum makes one rotation, the switch arm 212 is actuated and a signal is sent to a control panel.

When the system is in the "on" cycle, the drum rotates and the switch 210 is
20 not effective. However, when the system is switched to the "off" position, the signal from the switch 210 will immediately stop the drum drive by shutting off the electric motor and urging the pneumatic system, as will be described later. This will stop the drum within a travel of about $\frac{3}{4}$ inch to position the door 170 of the drum at a precise location as the drum is often loaded through the door passage, either by a forklift
25 truck or conveyor.

As previously described, the drive for the rotation of the drum is provided by a variable drive pulley, as illustrated in Figure 21. A preferred embodiment of the

WE CLAIM:

1. A hay bale processor (10) comprising container means (14) for receiving a bale of hay (156, 157) to be cut in fibers, a rotor (28) secured below said container means, said rotor having a plurality of cutting blades (35) disposed about its periphery in space-part parallel relationship, said rotor being aligned with a grill (26) in a bottom wall (23) of said container means and said grill having spaced-apart, parallel, slot openings (27) defining an average fiber cut length therebetween, said blades being aligned with respective ones of said slot openings and projecting therethrough to contact a bottom face (159) of a bale (160) of hay displaced over said grill by bale displacement means (140, 240) associated with said container means whereby to cut hay from said bottom face, said fibers being discharged through said slots and into discharge conveying means (18), characterized in that said rotor has a drivable shaft (29) secured to a displaceable suspension mechanism (45) to displace said rotor and consequently said blades of said rotor above said grill a variable distance depending on the resistive load applied to said blades of said rotor when a bale of hay is displaced over said grill, electric motor means (66, 67) coupled to said drivable shaft for rotating same, said displaceable suspension mechanism (45) having pressure biasing means (50, 280) having a predetermined biasing pressure value, said cutting knives being displaced to retract within said slots when said predetermined biasing pressure value is exceeded by the load on said cutting blades of said rotor whereby said electric motor means maintains a substantially constant drive torque on said rotor drivable shaft and a substantially constant speed of rotation of said rotor.
2. A hay bale processor as claimed in claim 1, wherein said pressure biasing means (50) is a pressure cylinder producing a substantially constant biasing force on said drivable shaft (29) in the direction of said grill.
3. A hay bale processor as claimed in claim 2, wherein said pressure cylinder (50) is an air pressure cylinder.
4. A hay bale processor as claimed in claim 3, wherein said displaceable suspension mechanism (45) comprises a pair of pivotal arms (46, 46') each having a fixed pivot end (48), said drivable shaft (29) being supported adjacent opposed ends of said drivable shaft by a respective one of said pivotal arms, said air cylinder (50) having

a piston rod (51) with a piston rod end (52) thereof secured to one of said pivotal arms (46) and applying said substantially constant upward biasing force on said one of said pivotal arms.

5. A hay bale processor as claimed in claim 4, wherein a driven pulley (65) is secured to an extension end of one of said opposed ends of said drivable shaft extending through its associated pivotal arm (46), said electric motor means being an electric motor (66) having a drive shaft (69), a drive pulley (68) secured to said drive shaft, a drive belt (70) about said driven pulley and drive pulley to impact axial rotation to said driven pulley, and automatically adjustable tension means (72) to maintain said drive belt taut when said driven shaft is displaced when said predetermined biasing pressure value is exceeded by the load on said cutting blades.
6. A hay bale processor as claimed in claim 5, wherein said driven pulley (65) is a double sheave pulley, there being two of said electric motors (66, 67), each motor having an associated one of said belt (70, 71) trained about an associated one of said double sheaves (65), said automatically adjustable tension means being constituted by a floating pulley (72, 73) which is spring biased against a portion of said drive belt (70, 71) of each motor and between said double sheave pulley and drive pulley.
7. A hay bale processor as claimed in claim 4, wherein the other pivotal arm (46') is provided with a piston (53) secured to a free end (55) thereof to remove vibration and to stabilize said drivable shaft (29) of said rotor.
8. A hay bale processor as claimed in claim 4, wherein one of said pivotal arms (46, 46') is provided with adjustable arresting means (57, 58, 59) to limit the displacement of said pair of pivotal arms to position said cutting blades from a retracted position below said slot openings of said grill and a maximum working position wherein said blades project above said slot openings a maximum distance.
9. A hay bale processor as claimed in claim 8, wherein said adjustable arresting means is constituted by a pair of abutment members (58, 59) positioned spaced from one another and disposed on opposed sides of a free end portion of said one of said pivotal arms (46, 46'), at least one of said abutment members (59) having an adjustable abutment face (62') disposed to define said maximum distance.

10. A hay bale processor as claimed in claim 3, wherein said spaced-apart slot openings (27) are elongated rectangular slot openings, said openings having adjustable means (90) to vary the width of each said slot simultaneously.
11. A hay bale processor as claimed in claim 10, wherein said adjustable means (90) is provided by at least one displaceable plate (85) having elongated rectangular slot openings (27) therein, which are spaced apart a predetermined distance and defining obstructing wall sections between said slot openings, said displaceable plate 85 being retained in frictional contact under uppermost-like slot openings, said displaceable plate being displaceable to register its slot openings (27) with said uppermost-like slot openings (27') or to obstruct a portion of said uppermost slot openings by said obstructing wall sections whereby to adjust the width of said slots and thereby said average fiber cut length.
12. A hay bale processor as claimed in claim 11, wherein said grill is constituted by a rectangular opening (24) in said bottom wall (23), there being provided two of said displaceable plates (85, 87), said plates being rectangular plates held under said rectangular opening and disposed in frictional contact with one another and with a bottom face 88 of said bottom wall (23) of said container means, a displaceable linkage (90) secured to said displaceable plates to displace both said plates with respect to one another whereby to vary the width of each said slots simultaneously.
13. A hay bale processor as claimed in claim 12, wherein said displaceable linkage (90) comprises an actuating arm (91) secured adjacent one end to a stationary pivot (93), a pair of link arms (94, 95) each secured to a respective one of a pivot connection (96, 97) on said actuating arm and disposed on opposed sides of said stationary pivot, said pair of link arms (94, 95) being secured at their other end to a respective one of said two displaceable plates, and a lever (98) secured at the other end of said actuating arm to displace said actuating arm a limited distance about said stationary pivot.
14. A hay bale processor as claimed in claim 13, wherein said lever (98) extends through a slot (99) provided in said bottom wall (23), said slot defining between opposed ends thereof said limited distance.

15. A hay bale processor as claimed in claim 14, wherein said lever has an engageable end (100) associated with a grid (101) defining a range of said average fiber cut lengths to permit a user person to select a desired average fiber cut length.
16. A hay bale processor as claimed in claim 4, wherein said pressure cylinder (50) is secured to a pressurized air reservoir (80), a compressor (83) to supply compressed air to said reservoir, a pressure regulator (81) to adjust the air pressure in said reservoir, said pressure regulator (81) adjusting said predetermined pressure value on said pivotal arm (46) and drivable shaft supported thereby dependent on the rating of said electric motor means (66, 67) to maintain said substantially constant drive torque.
17. A hay bale processor as claimed in claim 4, wherein said rotor drivable shaft (29) is provided with a plurality of blade support discs (30) secured in equidistantly spaced relationship along said drivable shaft, said discs (30) having blade attachment shoulders (32), each shoulder having a pair of spaced holes (33) to receive fasteners to secure a cutting blade (35) thereto, said blades each having at least one cutting edge (36) angulated to an apex (37) thereof, said pair of spaced holes providing for said blade to be attached to said attachment shoulders with said apex lying substantially on a diametrical axis (39) of said support disc, and a further hole (33') disposed below a trailing one of said pair of spaced holes to secure said blades (36') slanted rearwardly of said diametrical axis.
18. A hay bale processor as claimed in claim 1, wherein said container means is a circular drum (14) supported elevated on a support frame, said drum having a cylindrical wall (16) rotatable over a top wall of said support frame and which constitutes said bottom wall of said container means, support guide means (105) maintaining said cylindrical wall (16) in a constant peripheral vertical guide plane, said drum being rotated by an endless belt (110) trained about belt engagement means (111) secured about a lower portion of said cylindrical wall 16 and a drive sheave (113).
19. A hay bale processor as claimed in claim 18, wherein said cylindrical wall has at least a wall portion thereof being a hinged wall portion (170) for access to the interior of said circular drum (14).
20. A hay bale processor as claimed in claim 18, wherein said top wall (15) of said support frame (12) is a rectangular top wall, said top wall being hinged to said

frame, and a piston (21) actuatable to hinge said top wall and said circular drum upwardly on a hinge connection (20) to provide access below said top wall and to said grill.

21. A hay bale processor as claimed in claim 18, wherein said drive sheave (113) is a gear box drive sheave driven by a variable speed drive.

22. A hay bale processor as claimed in claim 21, wherein said variable speed drive is constituted by a variable drive sheave (116), a variable tension drive belt (117) trained about said variable drive sheave and a drivable sheave (115) of said gear box, and drive belt tensioning means (118, 120) to vary the circumference of said variable drive sheave and the speed of rotation of said drivable sheave of said gear box.

23. A hay bale processor as claimed in claim 22, wherein said drive belt tensioning means is constituted by at least one displaceable sheave (118) biased against said variable tension drive belt (117) by a linkage (120), said linkage (120) being actuatable to displace said displaceable sheave by a control arm (121) engageable at one of two or more arm engaging positions (122), each said arm engaging position applying a different tension on said drive belt to cause said gear box drive sheave to rotate at a different speed whereby said cylindrical side wall (16) of said drum (14) may be rotated at different speeds.

24. A hay bale processor as claimed in claim 23, wherein said variable drive sheave (116) is driven by said electric motor means (66).

25. A hay bale processor as claimed in claim 24, wherein said electric motor means (66) is coupled to an auger screw drive shaft (133) located in a discharge trough under said rotor and constituting said discharge conveying means, said variable drive sheave (116) being secured to a free end of said auger screw drive shaft (33).

26. A hay bale processor as claimed in claim 4, wherein there is further provided arresting means to limit the displacement of said pair of pivotal arms to position said cutting blades from a retracted position below said slot openings of said grill and a maximum working position wherein said blades project above said slot openings a maximum distance, said arresting means being constituted by a guide slot (67) in a side wall (12) of a support framework (11) under said container means (14) and through which extends said drivable shaft of said rotor.

27. A hay bale processor as claimed in claim 18, wherein said cylindrical wall (16) is provided on an inner wall surface thereof with two or more of said bale displacement means (140) for engaging a bale of hay (156, 157) and displacing said bale over said grill (26).

28. A hay bale processor as claimed in claim 27, wherein said bale displacement means is constituted by vertically hinged bale engaging fins (140) secured vertically to said inner wall surface (16') by hinge means (141, 142), said bale engaging fins each having a sloped outer edge (144) sloping outwardly and inwards in said tub from a top end to a bottom end, said fins being displaceable towards said inner wall surface (16') on one side of said hinge means when displaced by a bale of hay when inserted in said tub and engaging said bale of hay by stopper means (147) which arrest said fins from displacement against an opposed side of said hinge, said opposed sides trailing the direction of rotation (146) of said tub.

29. A hay bale processor as claimed in claim 28, wherein said stopper means (147) is an angulated reinforcing plate secured to each said fins at a lower wide end portion thereof, said reinforcing plate (147) abutting said inner wall surface (16') on said opposed side of said hinge means.

30. A hay bale processor as claimed in claim 28, wherein said bale engaging fins are provided with attachment means (149) to provide for attachment of fin extension plates (150).

31. A hay bale processor as claimed in claim 18, wherein said cylindrical wall is provided with sighting windows (151) to view the interior of said tub.

32. A hay bale processor as claimed in claim 18, wherein said bottom wall of said tub is provided with at least one arcuate guide rib (155) projecting upwardly from a top surface of said bottom wall (23), said arcuate guide rib (155) being disposed upstream of said grill whereby to shift said bale (160) being displaced over said grill to prevent the formation of cut-out channels (158) in said lower surface (159) of said bale by said cutting blades.

33. A hay bale processor as claimed in claim 32, wherein there are two or more of said arcuate guide ribs (155) disposed spaced-apart in substantially parallel relationship, each rib having a top edge (160) sloping upwardly from a front end (161) to a rear end (162) thereof, said rear end (162) being disposed adjacent said grill.

34. A hay bale processor as claimed in claim 1, wherein said bale of hay is a circular bale of dry hay.

35. A hay bale processor as claimed in claim 1, in combination with an animal feed mixer (180), said discharge conveying means having a discharge port, said discharge port having a coupling flange (181) to removably secure a connecting conduit (182) thereto and to a fiber feeding inlet port (183) of said animal feed mixer for mixing said fibers of average cut length with other animal feed products (186).